F. RAY.

SURFACE CONDENSER.

APPLICATION FILED SEPT. 24, 1912.

1,137,422.

Patented Apr. 27, 1915.

3 SHEETS—SHEET 1.

Fig. 1

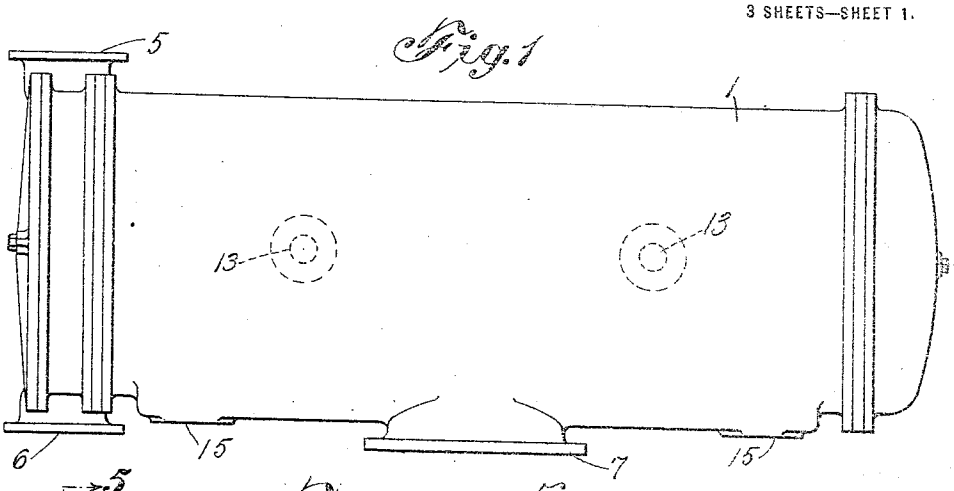


Fig. 2

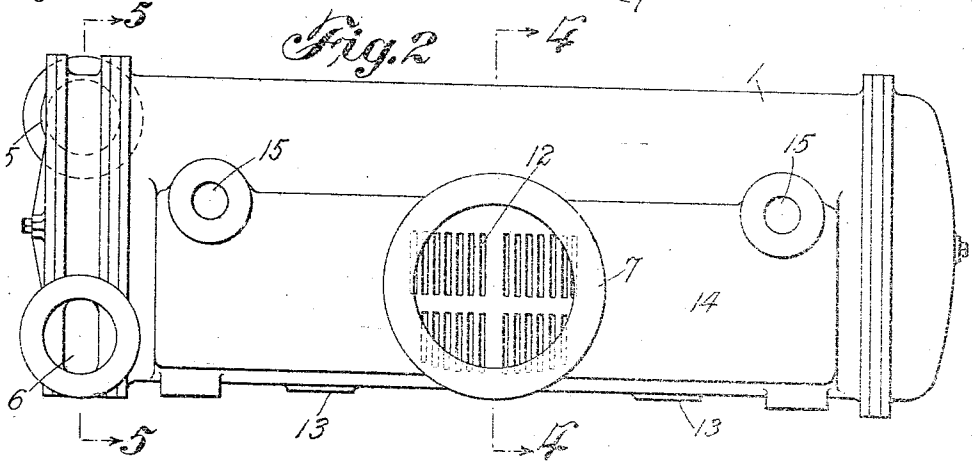
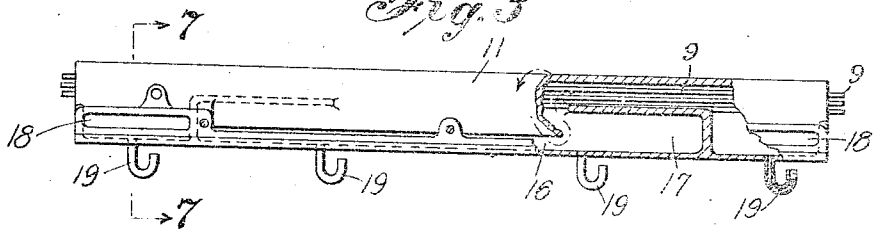


Fig. 3



Witnesses

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3 SHEETS—SHEET 2.

Fig. 4

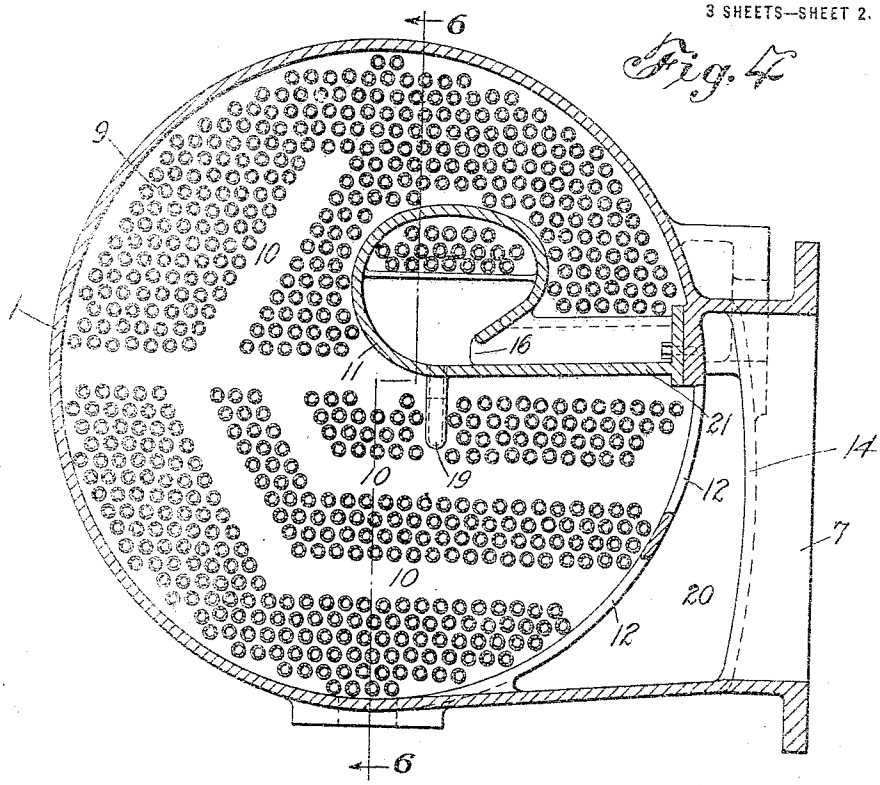
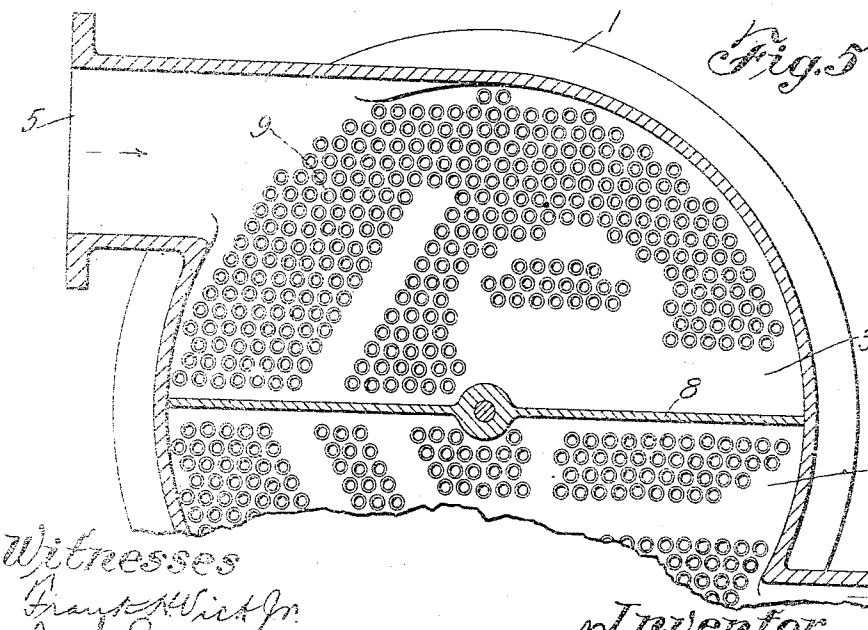


Fig. 5



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3 SHEETS—SHEET 3.

Fig. 6

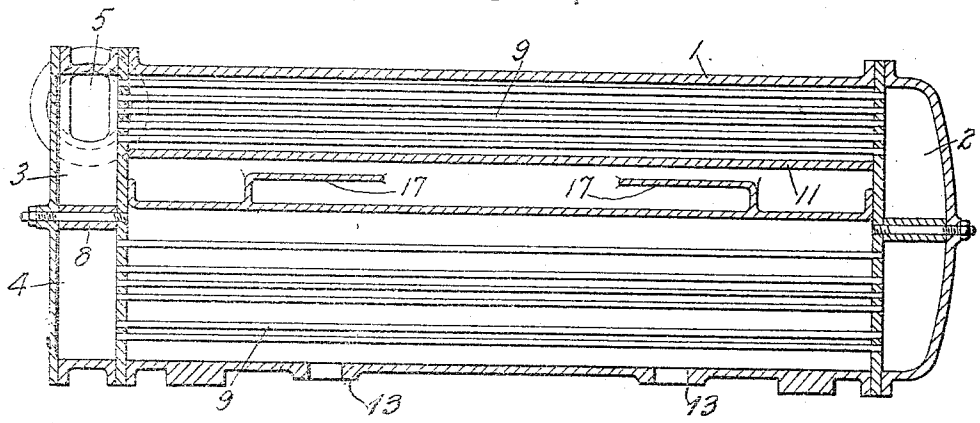
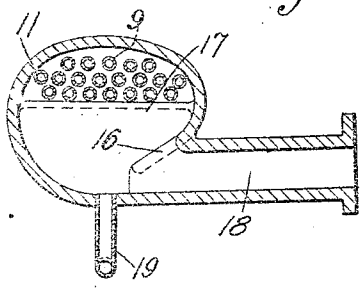


Fig. 7



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Inventor
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UNITED STATES PATENT OFFICE.

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SURFACE CONDENSER.

1,137,422. Specification of Letters Patent. **Patented Apr. 27, 1915.**

Application filed September 24, 1912. Serial No. 722,008.

To all whom it may concern:

Be it known that I, FREDERICK RAY, a citizen of the United States, residing at Short Hills, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Surface Condensers, of which the following is a specification, reference being had therein to the accompanying drawing.

My present invention relates to certain new and useful improvements in condensers and more particularly to surface condensers, the object being to facilitate the condensation of the steam and the removal by the dry vacuum system of the air and uncondensable vapors remaining after the steam is condensed.

The invention consists essentially in a surface condenser having a spirally-shaped condensing chamber with the steam entering at the large end of the spiral and the air and uncondensable vapors withdrawn at its small end; and the invention also comprises numerous details and peculiarities in the construction, arrangement and combination of parts substantially as will be hereinafter described and claimed.

In the accompanying drawing illustrating my invention:—Figure 1 is a top plan view of my improved surface condenser. Fig. 2 is a side elevation of the same. Fig. 3 is a detail view in partial section of the partition employed within the condenser shell for forming the spiral condensing chamber. Fig. 4 is an enlarged cross-section on the line 4, 4, of Fig. 2. Fig. 5 is an enlarged cross-section on the line 5, 5 of Fig. 2. Fig. 6 is a longitudinal section on the line 6, 6 of Fig. 4. Fig. 7 is a cross-section on the line 7, 7 of Fig. 3.

Similar characters of reference designate corresponding parts throughout all the different figures of the drawing.

1 denotes the usual cylindrical shell of a surface condenser, the same having any suitable dimensions and built in any approved style. At one end of the shell 1 is a chamber 2 covering the entire head of the shell, while at the other end are two independent chambers 3 and 4, each covering one-half of the end of the shell and separated by an intervening partition 8. Horizontal water tubes 9 are located within the shell 1 and extend between the end chambers 2, 3 and 4 with which they communicate. Chamber 3 has a water inlet 5 and chamber 4 has a water outlet 6. The course of the water, therefore, is from the chamber 3 through a part of the tubes 9 into the chamber 2, and then back from chamber 2 through the rest of tubes 9 to the chamber 4 having outlet 6.

On one side of the shell 1, preferably at a point about midway of its length, is an opening 7 for the admission of the exhaust steam, said opening being usually a large round opening and consisting of an inlet pipe or sleeve cast integral with the shell 1, which shell opposite the pipe 7 is provided with vertical slots 12 to form a sort of grating through which the steam passes into the interior of shell 1, where it comes into contact with the water-cooled tubes 9, and the steam entering through pipe 7 strikes this grating and is deflected thereby in both directions into the steam space 20 and into the interior of the shell. This grating consisting of slots 12 may extend a greater or less distance throughout the steam space 20, but it will often be found sufficient to have the slots only in the immediate neighborhood of the opening 7. On the under side of the shell 1 are suitable openings, one or more, for the withdrawal of the water of condensation, as 13, 13, where the condensed water pump connections are made. Also, on the side of the shell contiguous to the exhaust inlet 7, cast therewith and running substantially the entire length of the shell, is an outer wall 14 which forms in the outer part of the shell, a steam inlet space as indicated at 20 in Fig. 4. It will be further noticed that this outer auxiliary wall 14 carries air outlet openings 15, one or more as preferred, to which are connected the dry air pump whose function it is to remove air from the interior of the condenser shell. These openings 15 do not communicate with the space 20, but only with the small end of the spiral condensing chamber within the shell where the air and uncondensable vapors remain after the condensation of the steam has been affected, as will be presently explained.

Inside the shell 1 is a curved longitudinal partition plate 11, see Fig. 3, supported by the ends of the shell, and of such a shape that in combination with the cylindrical shell 1 it forms a spiral chamber which is

largest at the end near the exhaust opening 7, and which narrows down to a small end whence the air is withdrawn. This partition plate 11 is eccentrically placed in the shell 1 and in form has a flat longitudinal part 21 which merges at its inner end into a curved part that approaches in shape that of a cylinder, but by noticing the cross-section in Fig. 4 it will be seen that while the shell 1 is a complete cylinder the placing of this eccentric curved plate 11 therein provides a condenser chamber which is curved and which decreases in size from a large end to a rather small end. The partition 11 is shown in detail in Fig. 3 and in cross-section in Fig. 7. It has an opening at 16 which extends longitudinally along the side of the same between the two angular plates 17, so that air entering the chamber inside of the partition 11 will pass in through the elongated opening 16 as indicated by the arrow in Fig. 3, thus flowing under the angular partitions 17 and being directed thereby circuitously, as shown by the arrow in Fig. 3, over said partitions 17 and in opposite directions into the ends of the interior of the space within partition 11. These ends connect through narrow channels 18 with the air outlets 15. The partition plate 11 is, furthermore, provided at intervals along its bottom with sealed drains 19 that allow the water of condensation from the interior of the partition 11 and from the condenser tubes above said partition to drain into the bottom of the main condenser. These drain pipes 19 are curved, as shown, to form a water seal to prevent the direct entrance of the steam upward into the interior of the partition 11. Thus it will be seen that in a sense the partition plate 11, which, with the cylindrical shell 1, forms a spiral condensing chamber, has itself a condensing and cooling function within its interior chamber, and may be properly termed an auxiliary condensing chamber for some of the tubes 9 lie inside of this auxiliary chamber, and these tubes in this auxiliary chamber are cold tubes, since the partition 11 is above the center of the main condensing chamber where are the tubes that receive the coldest water from chamber 3.

While the tubes 9 that connect the water chambers at the ends of the main shell 1 may be said to occupy substantially the whole of the interior space within shell 1, it will be seen that they are omitted opposite the horizontal partition 8 between the chambers 3 and 4, as there could be no suitable attachment effected adjacent to said partition, and also I find it convenient to omit them along certain lines so as to furnish passages 10 leading from the exhaust steam inlet around among the bank of tubes so that a larger volume of steam may flow quickly to parts of the shell more remote from the exhaust inlet and thus a larger volume of steam be brought into contact instantly with a larger number of tubes. These spaces 10 thus permit quick and effective circulation and condensation.

As the steam enters through the inlet 7 and steam space 20 and flows thence into the condenser shell 1 it will come into contact with the water-cooled tubes 9, with a large number at first, and with a less number as the steam progresses around through the spiral condensing chamber, until the steam will finally reach the small end of the spiral, by which time it will have practically all been condensed. The cross-section of the spiral obviously decreases in proportion to the condensation of the steam, and at the end of the spiral chamber there is remaining only air and uncondensable vapors. These pass through the longitudinal opening 16 into the interior of the auxiliary chamber formed by the partition plate 11. As already explained this auxiliary chamber has also the function of an air cooler. Air finds exit from this auxiliary chamber through the openings 18 and the air exits 15. Said auxiliary chamber prevents the entrance of steam directly to the vacuum pump, while at the same time permitting the entire main condenser shell to be filled with steam, thus utilizing the whole tube surface effectively.

Although the exhaust opening 7 is shown arranged horizontally, I do not wish to be confined to such a location for it may be placed vertically or otherwise as desired by simply turning the whole condenser around, leaving the relation of the various parts the same. It will thus be found that a surface condenser having a spirally-shaped shell with the steam entering at the large end perpendicular to the tubes and the air withdrawn at the small end, provides an economical and effective construction for a surface condenser which gives uniformly excellent results. Such a spiral main chamber combined with an auxiliary chamber and air cooler at the small end of the spiral is an advantageous structural feature.

Various changes in the construction and arrangement of the parts may be made without exceeding the scope of my invention, and I, therefore, reserve the liberty of making all such changes as experience may dictate to be useful or necessary.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a surface condenser, the combination with an outer cylindrical shell, of an inner partition forming with said shell a spiral condensing chamber receiving the exhaust steam at its larger end, said partition being curved and having a lateral opening and forming an auxiliary condensing chamber receiving therein the air and uncon-

densable vapors which are cooled in said auxiliary chamber and then removed therefrom.

2. In a surface condenser, the combination with an outer cylindrical shell; of an inner partition forming with said shell a spiral condensing chamber receiving the exhaust steam at its larger end, said partition being curved and having a flat portion separated from the curved part to provide a lateral opening for the admission of the air and uncondensable vapors into an auxiliary chamber within the partition and adjacent to the small end of the spiral chamber, the air and uncondensable vapors being cooled in said auxiliary chamber and being withdrawn therefrom.

3. In a surface condenser, the combination with an outer cylindrical shell, of an inner eccentric curved partition forming with said shell a spiral condensing chamber receiving the exhaust steam at its larger end, said partition forming an auxiliary condensing chamber having a lateral opening in the smaller end of the main spiral chamber and receiving through said opening the air to be cooled.

4. In a surface condenser, the combination with a shell, of an inner eccentric curved partition having a flat portion separated from the curved part to leave a lateral longitudinal opening, said partition forming with the outer shell a spiral condensing chamber receiving the exhaust steam at its larger end and through which the steam courses and delivers air and uncondensable vapors into the interior of the partition at the small end of the spiral chamber, said partition thus providing an auxiliary chamber which serves as an air cooler and from which the air is withdrawn from the condenser.

5. In a surface condenser, the combination with a shell, water chambers at the ends, and connecting water-cooled tubes, of a partition or baffle plate eccentrically placed within the shell so as to form with the latter a spiral condenser chamber receiving the steam at its larger end, said partition having an internal cooling chamber having a longitudinal side opening which receives the air and uncondensable vapors and allows them to be removed from the condenser.

6. In a surface condenser, the combination with an outer shell, of an inner partition or plate forming with said shell a spiral condensing chamber receiving steam at its larger end, while at its smaller end the air and uncondensable vapors enter the interior of a chamber formed within said internal partition and having a longitudinal side opening, and angular plates within the latter chamber for directing the course of the air so that it may be removed from the condenser.

7. In a surface condenser, the combination with an outer cylindrical shell having an exhaust opening entering a lateral chamber surrounding a part of the cylindrical shell, and an internal eccentric partition forming with the outer shell a spiral condensing chamber, said partition inclosing an auxiliary condensing chamber having air outlets, and angular partitions in said auxiliary condensing chamber for directing the course of the air toward the air outlets from the point where it enters the auxiliary condensing chamber.

8. In a surface condenser, the combination with a spiral condensing chamber, of an auxiliary condensing chamber formed within the partition which forms one side of the spiral chamber, said auxiliary condensing chamber having condensation water outlets, air outlets, and an air inlet passage, and angular plates within the auxiliary condensing chamber for directing the course of the air from the inlet toward the outlets, substantially as described.

9. In a surface condenser, the combination of an outer shell, end water chambers, and connecting water-cooled tubes, a curved partition eccentrically placed within the shell and forming therewith a spiral condensing chamber receiving the exhaust steam at its larger end, while the air and uncondensable vapors accumulate at the smaller end and the interior of the curved partition providing an auxiliary condensing chamber having a longitudinal air inlet and one or more air outlets, and being provided also with curved water-sealed drains for the condensation water from said auxiliary condensing chamber and from the condensation in the small end of the spiral chamber above the auxiliary condensing chamber.

10. In a surface condenser, the combination with an outer shell, of an inner partition or plate forming with said shell a spiral condensing chamber receiving steam at its larger end, while at its smaller end the air and uncondensable vapors enter the interior of a chamber formed within said inner partition, said partition having a lateral opening to permit the entrance of the air and vapor.

In testimony whereof I affix my signature in the presence of two witnesses.

FREDERICK RAY.

Witnesses:

JEANNETTE STORK.

L. S. PERRINE.